Investigating the relative efficacy and economic feasibility of insecticides applied as seed treatments to control early and late season insect pests of spring canola

2004

Jack Brown, Jim B. Davis, and Joseph McCaffrey
Plant Soil and Entomological Sciences, University of Idaho,
Moscow, ID 83844-2339
Tel: (208) 885-7078; E-mail: jbrown@uidaho.edu

Introduction

Damage caused by insect infestation is a major factor in yield loss of all agricultural crops. In the Pacific Northwest region of the US, spring canola (*Brassica napus* L.) is especially vulnerable to insect pests. Flea beetle (*Phyllotreta cruciferae* (Goeze)), an early season insect pest, can cause considerable yield reduction in canola. Major late season insect pests of canola in the Pacific Northwest include: diamondback moth (*Plutella xylostella* L.), cabbage seedpod weevil (*Ceutorhynchus assimilis* Paykull), and aphids (cabbage aphid, *Brevicoryne brassicae* L., turnip aphid, *Lipaphis erysimi* (Kaltenbach), and green peach aphid, *Myzus persicae* L.). Infestations of these late season insects are typically controlled with foliar applications of insecticides when a threshold population of the pest is reached. These insect pests can typically cause yield losses of 20% to 50% in spring canola if not controlled. A severe infestation of flea beetles can completely destroy a stand of canola seedlings. Faced with such dire consequences, growers are forced to control these pests. Severe infestations of more that one pest species can require two applications to minimize yield losses.

The number of foliar-applied insecticides registered for canola is limited, and the multiple applications often required can be costly. Several seed-applied insecticides are currently registered for use in canola, and these seed treatments have been shown to be quite effective against flea beetles. However, little impartial information is available to growers regarding the relatively effectiveness of these insecticides compared to each other. In addition, some researchers and growers have observed that the seed-applied insecticides may have an effect on late season pests, but the degree and consistency of any such effect is poorly documented.

Most spring canola seed is available pretreated with seed-applied insecticides that control flea beetles, the primary early season insect pest. Since multiple insecticidal seed treatments are on the market, growers need objective data to make an informed choice between the available products. This research project is examining only registered pesticides that are currently in use.

Research Objectives

This project compares the relative efficacy of three insecticides (thiamethoxam, imidacloprid, and clothianidin) applied as seed treatments on early and late season pests of spring canola.

Research Procedures

The experiment was planted at two locations in northern Idaho, near Genesee on April 13, 2004 and near Moscow on April 11, 2004. Hard rains after planting at the Genesee site resulted in erosion and soil crusting, and the trial was replanted on May 6, 2004. Three canola cultivars, 'UI.00.3.1.17,' 'Sunrise,' and 'Marksman' (formerly 'SWF5229RR'), representing early, intermediate and late maturity classes, respectively, were used.

Four seed treatments were applied using label rates to seed of each cultivar; Helix™Xtra (thiamethoxam), Gaucho® 480 (imidacloprid), Poncho™ 600 (clothianidin), and no insecticide. Since Helix™Xtra contains three fungicides (difenoconazole, mefenoxam, fludioxonil) in addition to the insecticide thiamethoxam, the other three treatments included equivalent rates of the three fungicides. Clothianidin is now being marketed in a new formulation for canola called Prosper™; the rate of clothianidin used was equivalent to the high rate of Prosper™. For clarity, the clothianidin treatment will be referred to as Prosper™ in the rest of this report.

Late season pests were subjected to two treatments; a foliar spray of Capture® 2EC (bifenthrin) on each cultivar-seed treatment combination, or no foliar spray on each cultivar-seed treatment combination. Each trial was a split plot design with the late season treatments as the main plots and the cultivar-seed treatment combinations as the subplots. Late sprays were applied on June, 29, 2004 when diamondback moth larvae and aphid populations began to escalate.

A number of parameters were monitored during the growing season. A flea beetle damage score and plant stands were recorded, and the date of flower onset was noted for each plot as the plants began to flower. After the late season spray, diamondback moth and cabbage seedpod weevil populations were assessed once by taking two sweep samples from each plot. Aphid pressure was assessed by counting the number of infested racemes in a group of 30 randomly selected racemes in each plot. To obtain a score for aphid infestation, the number of non-infested racemes was multiplied by 3, the number of lightly infested racemes was multiplied by 2, and the number of heavily infested racemes was multiplied by 1. The sum of these products was then divided by 30. A non-infested plot would have a score of 3, while a severely infested plot would have a score of 1. Plots were harvested with a small plot combine to measure yield, and oil content of the harvested seed was determined by NMR analysis on a subsample of seed from each plot.

Results

The seed treatment insecticides did not improve plant stand counts as they had in the previous year, but all three insecticides resulted less flea beetle damage on the seedlings than the control (Table 1). The control seedlings had the most flea beetle damage, followed by Gaucho® 480, Prosper™, and Helix™Xtra, each with successively less damage, respectively. The seed treatments also resulted in earlier flowering times. Use of Helix™Xtra, and Prosper™ reduced days to flowering by two and one half days compared to no treatment, and Gaucho® 480 reduced it by just over one day.

Late season insects, including diamondback moth larvae, were not present in sufficient numbers to evaluate until July. Even then, insect pressure was fairly low as indicated by scouting and counts. Plots were assessed for the presence of diamondback moth larvae, cabbage seedpod weevil, and lygus bug, but due the low number of insects, especially the latter two, the counts were totaled across all three species before statistical analysis. Total insect numbers showed no differences with respect to the seed treatments (Table 1); however insect populations were reduced by a foliar spray of Capture®2EC (Table 2). Aphid populations began to increase in early July, but remained relatively low throughout July. Even at the low infestation levels observed, plots that received the foliar insecticide treatment had a significantly lower infestation that those plots without such a treatment. The average score for untreated plots was 2.8 while the score of treated plots was 2.9. (A score of 3.0 indicates no infestation, and a score of 2.0 indicates a high infestation.) The seed treatments did not have an effect on aphid levels. Neither the seed treatments nor the foliar spray affected plant height (not shown).

Seed yield was significantly reduced without insect control. Plots that received no seed treatment insecticides or late season sprays had a mean yield of 1242 lbs. per acre. The Helix™Xtra and Prosper™ treatments that were supplemented with a late foliar spray had the best yields, 2355 and 2405 lbs. per acre, respectively (Table 2). Averaged across the foliar treatment, Helix™Xtra and Prosper™ produced similar yields, 2090 and 2135 lbs. per acre, respectively. Gaucho® 480 yields (1860 lbs. per acre) were statistically better that those obtained with no insecticidal seed treatment (1424 lbs. per acre), but were not as good as the yields of the other two seed treatments. Oil content in harvested seed was better with late season insect control. Mean oil content for plots with a late season foliar spray was 38.2%, while plots without late season insect control had a mean oil content of 36.3%. None of the three seed treatment insecticides improved oil content compared to the control.

Helix™Xtra and Prosper™ both provided excellent control of early season flea beetle infestations and resulted in significantly higher seed yield than the control. Gaucho® 480 also provided good flea beetle control and improved yield compared to the control, but it did not provide as much of a yield advantage as the other two seed treatments.

Table 1. Stand counts, flea beetle damage, days to flower from planting, and insect counts of canola with four insecticidal seed treatments grown at two sites in northern Idaho during 2004.

Seed treatment	Stand Count[1]	Flea Beetle Damage[2]	Days to Flower	Insect Counts[3]
	plants/ft of row	score	days after planting	insects/count
Fungicides Only	6.7	4.2 d[4]	61.4 a[4]	1.8
Gaucho® 480	6.7	7.3 c	60.1 b	2.5
Helix™Xtra	6.9	8.3 a	58.9 c	1.7
Prosper™	6.6	7.8 b	59.0 c	2.3
LSD	NS	0.4	0.4	NS

[1] Counted on June 10, 2004; [2] Assessed on May 4, 2004 at Moscow and June 11, 2004 at Genesee, score is on a 1 to 9 scale, 9 indicates no damage, 1 indicates complete loss of cotyledons; [3] Insect counts taken on July 2, 2004; [4] Means in a column with different letter suffixes are different based on Fisher's Protected L.S.D. (p=0.05).

Table 2. Insect counts, aphid infestation, yield, and oil content of canola with four insecticidal seed treatments and two foliar insecticide spray treatments grown at two sites in northern Idaho during 2004.

Seed Treatment	Late Season Spray	Insect Counts[1]	Aphid Colonies[2]	Yield	Oil Content
		number	score	lbs/acre	%
Fungicides Only	**None**	3.3	2.8	1242	36.2
	Capture®2EC	0.4	2.9	1607	38.0
	Mean	**1.8**	**2.8**	**1424**	**37.1**
Gaucho® 480	**None**	4.6	2.9	1668	36.4
	Capture®2EC	0.3	3.0	2053	38.0
	Mean	**2.5**	**2.9**	**1860**	**37.2**
Helix™Xtra	**None**	3.3	2.9	1824	36.1
	Capture®2EC	0.1	2.9	2355	38.9
	Mean	**1.7**	**2.9**	**2090**	**37.5**
Prosper™	**None**	4.3	2.8	1866	36.6
	Capture®2EC	0.3	2.9	2405	38.2
	Mean	**2.3**	**2.9**	**2135**	**37.4**

[1] Insect counts taken on Ju ly 2, 2004;
[2] Aphid score on a scale of 1 to 3, 3 indicates no infestation, 1 indicates heavy infestation, assessed on 7/15/2004

The cost and return of the treatments examined in this study are presented in Table 3. The yield values used to calculate gross return are the means of the Genesee 2003, the Genesee 2004, and the Moscow 2004 sites. (See the 2003 report for details of the 2003 trial.) The canola price used is 0.10 per pound. In general, all insecticide applications resulted in higher returns after the cost of the insecticide was deducted from the gross returns (Table 3). The lowest return per acre, $97, was with no insecticide application, and the best returns, $189 and $193 per acre, were when both early and late season insect pests were controlled using either Helix™Xtra plus Capture®2EC or Prosper™ plus Capture®2EC, respectively. Based on this data, the use of Helix™Xtra plus Capture®2EC or Prosper™ plus Capture®2EC are economically viable alternatives for spring canola growers in northern Idaho.

Table 3. The costs of eight seed treatment and foliar insecticide combinations applied to canola, the gross return based on seed yield at $0.10 per pound, and the return after the cost of insecticide treatments are deducted when grown at three locations in northern Idaho during 2003 or 2004.

Seed Treatment	Late Season Spray	Cost of Treatment	Gross Return	Return after Seed Treatment and Insecticide Cost
		$/acre	$/acre	$/acre
Fungicides Only	None	0.40	97	97
	Capture®2EC	14.29	135	121
Gaucho® 480	None	11.95	133	121
	Capture®2EC	25.84	176	150
Helix™Xtra	None	10.80	156	145
	Capture®2EC	24.69	214	189
Prosper™	None	8.88	163	154
	Capture®2EC	22.77	216	193

* The cost of clothianidin was calculated as the tank mix of Prosper and Poncho needed per label instructions to achieve the rate of clothianidin used.